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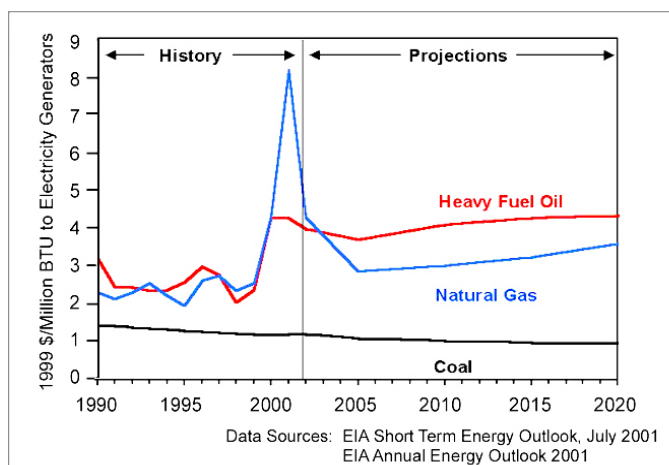
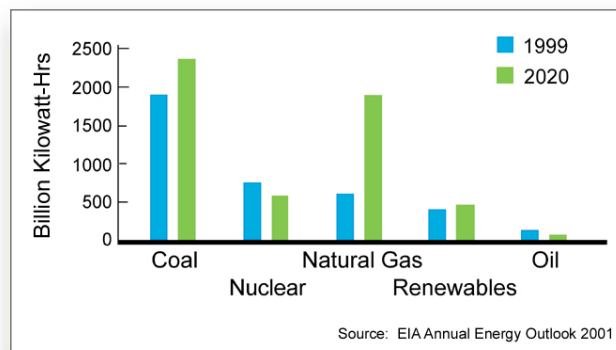
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## COAL PLAYS KEY ROLE IN ELECTRIC POWER GENERATION

About 90% of all coal usage in the United States is used for electricity generation and over half of all electricity in United States is produced by coal-fired power plants. As electricity demand is expected to grow by 2% annually over the next 20 years, more than 1300 new power plants could be needed by the year 2020. Additionally, as the existing fleet of power plants are aging and facing possible retirement, increased demand for electricity is forcing utilities to consider plant retrofits and repowering instead of plant shut downs. Although natural gas will play a more dominant role in the future of electric power generation, limited natural gas supplies, pipeline bottlenecks and erratic natural gas fuel costs will limit its contributions. Electric power generation must rely on multiple fuel sources. As emerging RD&D in coal fired power generation drives down the cost of electricity, capital cost, emissions, permitting lead times and investment risk, coal will continue to play a critical role in electric power generation in the United States.

### Coal Fired Power Generation Will Grow

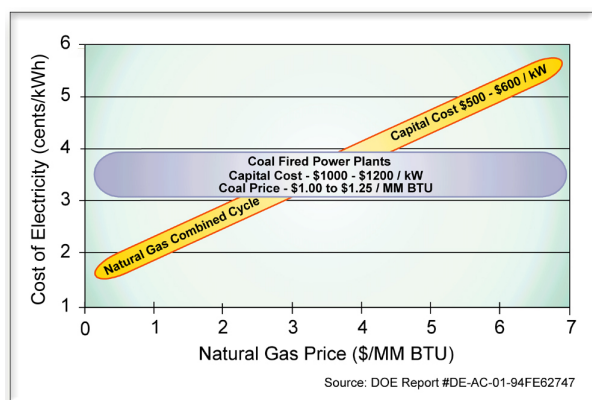


*Stable Coal Prices  
Erratic, Rising Natural  
Gas Prices*

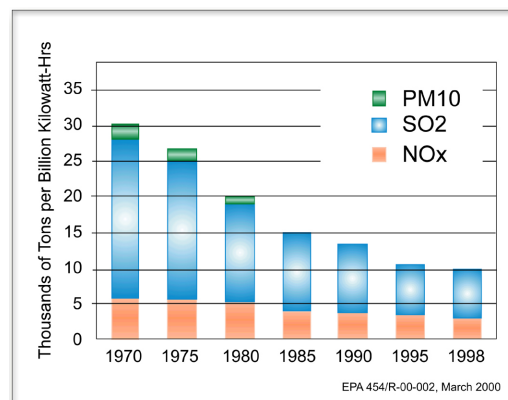
# COAL PLAYS KEY ROLE IN ELECTRIC POWER GENERATION

## Performance Comparison of Power Generation Technologies

	Average (1999)	State-of-the-Art (2000)			Future (2010)		
	PC	PC	IGCC	NGCC	PC	IGCC	NGCC
Nominal Efficiency HHV % (LHV%)	33	40	43	52 (57)	44	52	58 (63)
SO <sub>2</sub> Emissions lb/10 <sup>6</sup> Btu (lb/MWh)	1.3 (13.8)	0.05 (0.5)	0.02 (0.15)	0	0.025 (0.2)	0.017 (0.13)	0
NO <sub>x</sub> Emissions lb/10 <sup>6</sup> Btu (lb/MWh)	0.5 (5.2)	0.15 (1.3)	0.04 (0.31)	0.028 (0.20)	0.03 (0.3)	0.024 (0.20)	0.028 (0.18)
Particulate Emissions lb/10 <sup>6</sup> Btu (lb/MWh)	0.05 (0.5)	0.01 (0.08)	0.007 (0.053)	0	0.01 (0.08)	0.002 (0.015)	0
CO <sub>2</sub> Emissions (lb CO <sub>2</sub> /MWh)	2202	1817	1690	755	1652	1398	677
Fuel Type	Coal	Coal	Coal	Gas	Coal	Coal	Gas
Cost - \$/10 <sup>6</sup> Btu	1.2	1.2	1.2	3.5 - 7.5	1.1	1.1	4.0 - 7.0
Capital Cost 1999 \$/kW	N/A	1000	1200	550	950	1000	500
Cost of Electricity 1999 ¢/kWh	4.0	3.5	3.7	4.0 - 6.8	3.4	3.1	3.5 - 6.0



*State-of-the-Art Coal Technologies are Cost Competitive*



*Coal Technologies Keep Getting Cleaner*

## Basis / Assumptions for Technology Comparisons

	Average (1999)	State-of-the-Art (2000)			Future (2010)		
	PC	PC	IGCC	NGCC	PC	IGCC	NGCC
Technology	Sub Critical	Super Critical	Texaco O <sub>2</sub> Blown	"H" Frame	Ultra Super Critical	Advances in Sub Components	Next Generation Turbine
SO <sub>2</sub> Control Technology	Low Sulfur Coal and/or FGD	Wet Limestone 96% - 98%	Amine & Claus or Hot Gas Clean-Up	Sulfur Free Natural Gas	Wet Limestone > 99%	Hot Gas Clean-Up	Sulfur Free Natural Gas
NO <sub>x</sub> Control Technology	Combustion Mods such as Low NO <sub>x</sub> Burners	Low NO <sub>x</sub> Burner, and SNCR or SCR	Quench & Staged Combustion	Combustion Mods such as Zoning/ Staging	Low NO <sub>x</sub> Burner, and SCR	Quench & Staged Combustion	Combustion Mods, such as Zoning/ Staging
Particulate Control Technology	Baghouse or ESP	Baghouse or ESP	Ceramic Candle Filter	Particulate Free Natural Gas	Baghouse or ESP	Ceramic Candle Filter	Particulate Free Natural Gas
Size (MW)	350	400	350	400	400	500	400

Notes: Assumes levelized costs  
20 year book life  
Nominal 70% plant capacity factor  
Current maximum NSPS limits applicable to new plants

- SO<sub>2</sub> - 1.2 lbs/10<sup>6</sup> Btu and 90% reduction or 0.6 lbs/10<sup>6</sup> Btu and 70% reduction
- NO<sub>x</sub> - 1.6 lbs/MWh
- PM - 0.03 lbs/10<sup>6</sup> Btu

Nomenclature: PC = Pulverized Coal  
IGCC = Integrated Gasification Combined Cycle  
NGCC = Natural Gas Combined Cycle

References: DOE Report #DE-AC01-94FE62747  
EIA Annual Energy Outlook 2001  
DOE NETL Program Goals / Extrapolations  
Discussions with equipment vendors and contractors

**Web References:** DOE Report #DE-AC-01-94FE62747, [http://www.fe.doe.gov/coal\\_power/special\\_rpts/market\\_systems/market\\_sys.html](http://www.fe.doe.gov/coal_power/special_rpts/market_systems/market_sys.html)  
DOE Fact Sheet 014.p65, <http://www.netl.doe.gov/publications/factsheets/technical/tech014.pdf>